Badger Meter Europa GmbH

ModMAG® M1000

INSTALLATION AND OPERATION MANUAL

August 2014

MID_M1000_BA_02_1408

1. Basic safety precautions

Before installing or using this product, please read this instruction manual thoroughly.
Only qualified personnel should install and/or repair this product. If a fault appears, contact your distributor.

Installation
Do not place any unit on an unstable surface that may allow it to fall.
Never place the units above a radiator or heating unit.
Route all cabling away from potential hazards.
Isolate from the mains before removing any covers.

Power connection
Use only the type of power source suitable for electronic equipment. If in doubt, contact your distributor. Ensure that any power cables are of a sufficiently high current rating.
All units must be earthed to eliminate risk of electric shock.
Failure to properly earth a unit may cause damage to that unit or data stored within it.

Protection class
The device has protection class IP 67 and needs to be protected against dripping water, water, oils, etc.

Setup & operation
Adjust only those controls that are covered by the operating instructions. Improper adjustment of other controls may result in damage, incorrect operation or loss of data.

Cleaning
Switch off all units and isolate from mains before cleaning.
Clean using a damp cloth. Do not use liquid or aerosol cleaners.

Repair of faults
Disconnect all units from power supply and have it repaired by a qualified service person if any of the following occurs:

- If any power cord or plug is damaged or frayed
- If a unit does not operate normally when operating instructions are followed
- If a unit exposed to rain/water or if any liquid has been spilled into it
- If a unit has been dropped or damaged
- If a unit shows a change in performance, indicating a need for service.

⚠ WARNING

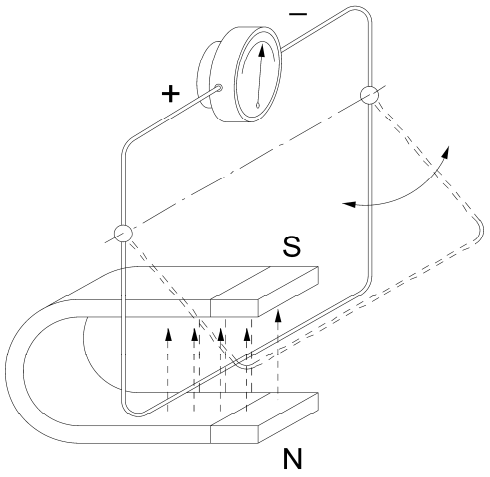
Failure to adhere to these safety instructions may result in damage to the product or serious bodily injury.

Remove device from the pipeline
If the device has been operated with toxic, caustic, flammable or water-endangering products you are kindly requested to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances before you remove the device.
Please read carefully chapter 9 “Return of goods for repair” and fill out the harmlessness declaration before you send back the device for repair.

RoHs
Our products are RoHs compliant.

2. System description

The electromagnetic flow meters are intended for the metering of all fluids with electric conductivity of at least 5 µS/cm (20 µS/cm for demineralized water). These series of meters is characterized by a high degree of accuracy. Measuring results are independent of density, temperature and pressure.



Measuring principle

In accordance with Faraday's induction principle, electric voltage is induced in a conductor moving through a magnetic field. In case of the electromagnetic flow measurement, the moving conductor is replaced by the flowing fluid. Two opposite measuring electrodes conduct the induced voltage which is proportional to flow velocity to the amplifier. Flow volume is calculated based on pipe diameter.

Measuring device

The measuring device consists of the detector and an amplifier. The detector is installed in the pipeline and is available in different sizes, pressure rates, process connections and materials. The amplifier is directly mounted on the detector or available as a remote version. The amplifier display and totalizes the flow with different in- and outputs. See also chapter 7 for more details.

Amplifier ModMAG®

Detector

Nameplate

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

Mod MAG
MAG Detector Head

Serial No.
Size
Max. Temp.
Nom. Pressure
Electrodes
Liner
Detector Factor
Protection rate

Mod MAG
MAG Amplifier

Model
Power supply
Protection rate

Badger Meter Europa
Neuffen Germany

3. Installation

⚠ WARNING

- *Installation instructions given in the following are to be observed in order to guarantee a perfect functioning and a safe operation of the meter.*

3.1 General information

3.1.1 Temperature ranges

⚠ CAUTION

- *In order to prevent a damaging of the meter, you are requested to strictly observe amplifier's and detector's maximum temperature ranges.*
- *In regions with extremely high ambient temperatures, it is recommended to protect the detector.*
- *In cases where fluid temperature exceeds 100 °C, foresee separate amplifier and detector (separate version).*

Amplifier	Ambient temp.		-20 °C to + 60 °C
Detector	Fluid temp.	PTFE / PFA	-40 °C to +150 °C
		Hard rubber	0 °C to +80 °C
		Soft rubber	0 °C to +80 °C

3.1.2 Protection class

In order to fulfill requirements in respect of the protection class, please follow the following guidelines:

⚠ CAUTION

- *Body seals need to be undamaged and in proper condition.*
- *All of the body screws need to be firmly screwed.*
- *Outer diameters of the used wiring cables must correspond to cable inlets (for M20 Ø 5 mm to 13 mm). In cases where cable inlet is not used, put on a dummy plug.*
- *Tighten cable inlets.*
- *If possible, lead cable away downwards. Thus humidity cannot get into cable inlet.*

We normally deliver the meter in accordance with protection class IP 67. If you however require a higher protection class, the amplifier is to be installed separately from the detector. If requested, we can also deliver the detector in IP 68.

3.1.3 Transport

⚠ CAUTION

- *Use lifting lugs when lifting meter flow tubes that are 150 in diameter or larger.*
- *Do not lift meter on measuring amplifier or on detector's neck.*
- *Do not lift meter with a fork lift on the jacket sheet. This could damage the body.*
- *Never place rigging chains, forklift forks, etc inside or through the meter's flow pipe for hoisting the meter. This could damage the isolating liner.*

3.2 Installation

In order to provide a perfect functioning and to prevent the meter from eventual damages, please follow the following installation instructions.

⚠ CAUTION

- *Carefully observe the forward flow label on the meter body and install the meter accordingly.*
- *As for detectors with PTFE liner, remove protective cap on the flange or on the threaded pipes of milk pipe screws as per DIN 11851 not until shortly before installation.*

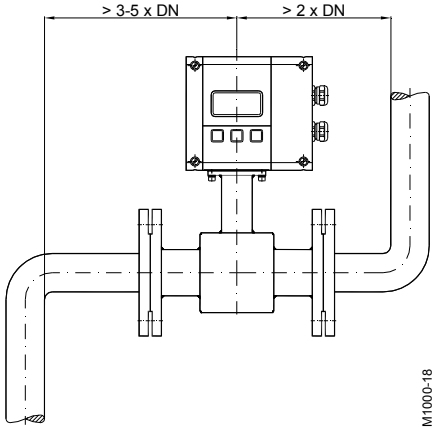
3.2.1 Meter orientation

Meters can operate accurately in any pipeline orientation. Meters can be installed in horizontal as well as in vertical pipelines.
Meters perform best when placed vertically with liquid flowing upward as it prevents solids build-up.
When installing the meter on a horizontal pipe, mount the meter to the pipe with the flow-measuring electrode axis in a horizontal plane as it prevents that gas bubbles result in a temporary isolation of the flow-measuring electrodes.

Carefully observe the forward flow label on the meter body and install the meter accordingly.

3.2.2 Inlet and outlet pipe

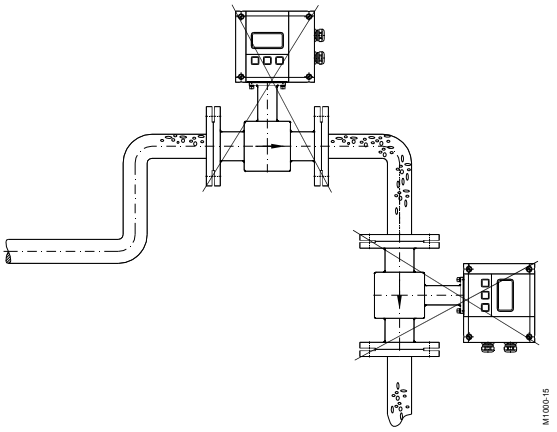
Always install the detectors in front of fittings producing turbulences. If this is simply not possible, foresee distances of > 3 x DN. Distance ought to be > 2 x DN.

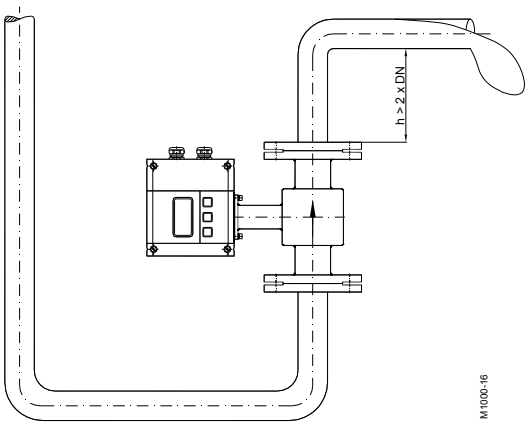


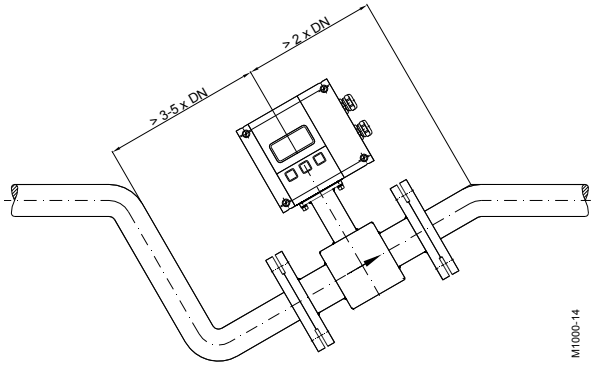
3.2.3 Meter location

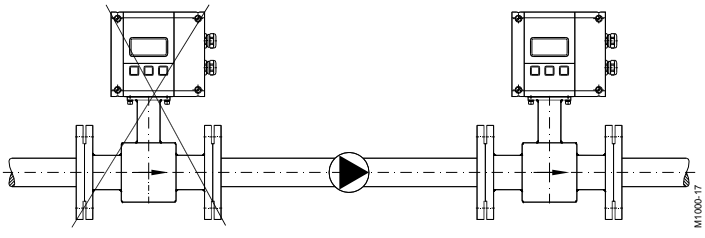
⚠ CAUTION

- *Do not install the detector on the suction sides of pumps. This could damage the liner (in particular PTFE liners).*
- *Verify that the pipeline is always filled on the measuring point, if not - a correct or accurate measurement is not possible.*
- *Do not install the detector on the highest point of a pipeline system. Gas accumulation may follow.*
- *Do not install the detector in downcomer pipes with free outlet.*
- *Do not install the detector on pipes with vibrations. If pipes are strongly vibrating, make sure that detector and amplifier are separated (separate version).*









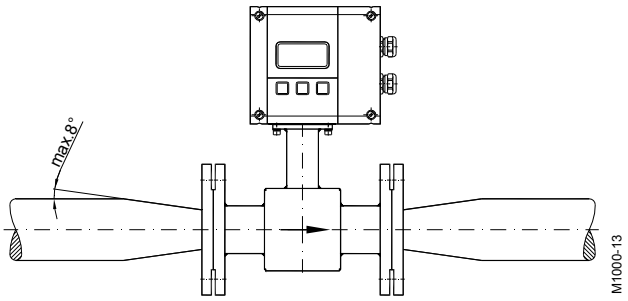
3.2.4 Pipe reducer requirements

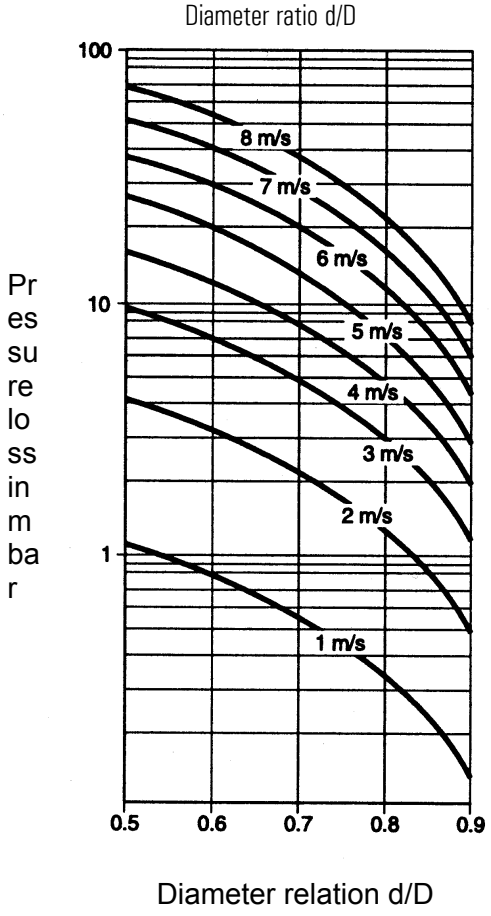
With pipe reducers as per DIN 28545 detectors can be mounted in larger pipelines.

You can determine the occurring pressure drop by using the shown nomogram (only applicable to liquids with similar viscosity like water).

Note:
- *In cases where flow velocities are very low, you can increment them by reducing the size on the measuring point and hence obtain a better measuring accuracy.*

D = pipeline
d = detector





Define pressure loss:
1. Calculate diameter ratio d/D.
2. Read pressure loss depending on d/D ratio and flow velocity.

3.2.5 Separate version

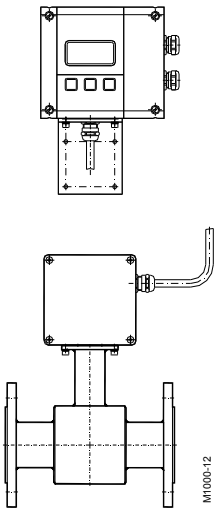
Provide a separate version in the following cases:

Note:

- *Detector protection class IP 68*
- *Medium temperature > 100 °C*
- *Strong vibrations*

⚠ CAUTION

- *Do not install the signal cable close to power cables, electric machines, etc.*
- *Fix signal cables. Due to capacity changes, cable movements may result in incorrect measurements.*
- *For medium temperature higher than 70°C make sure that any cable is not in contact with the hot surface of the detector*



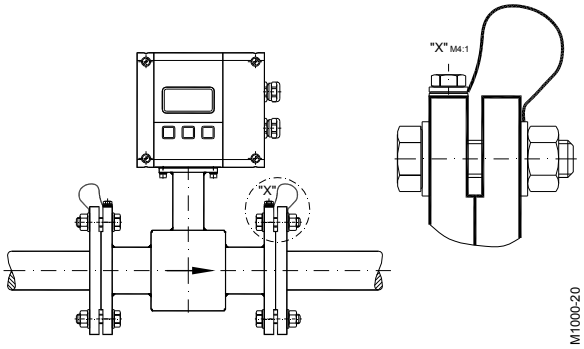
3.2.6 Grounding and potential equalization

In order to obtain an accurate measurement, detector and fluid need to be on the same electric potential.

If flange or intermediate flange versions with additional grounding electrode are used, grounding is provided by the connected pipeline.

⚠ CAUTION

- *In case of a type with flange a connection cable (min. 4 mm²) between grounding screw on the meter's flange to the counterflange is to be used in addition to the fixing screws. Verify that a perfect electric connection is provided.*
- *Color or corrosion on the counterflange may have a negative effect on the electric connection.*
- *In case of types with intermediate flanges, the electric connection to the detector is done via two ¼ AMP plugs installed on detector's neck.*

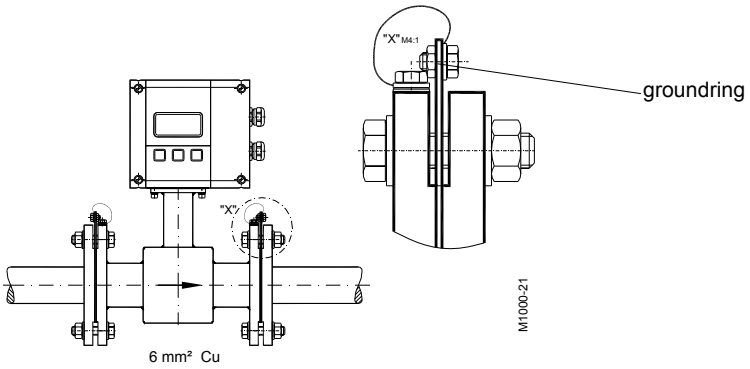


3.2.7 Plastic or lined pipelines

If non-conductive pipelines or pipelines lined with non-conductive material are used, install an additional grounding electrode or grounding rings between the flanges. Grounding rings are installed like gaskets between the flanges and are connected with a grounding cable to the meter.

⚠ CAUTION

- *When grounding rings are used, please make sure that the material is resistant to corrosion. If aggressive fluids are measured, use grounding electrodes.*

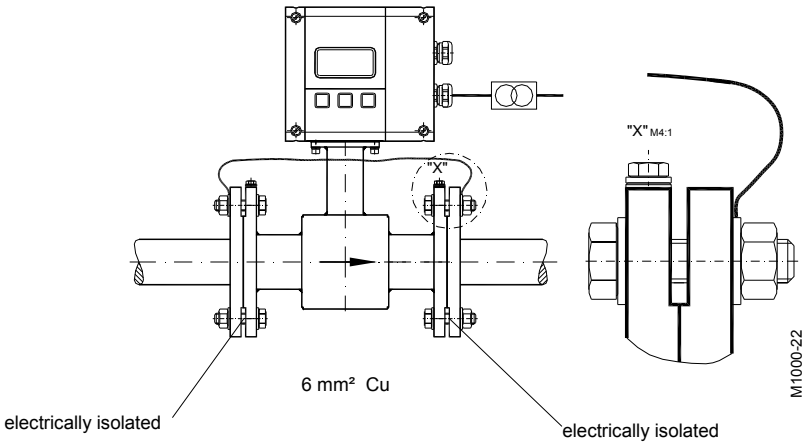


3.2.8 Pipelines with cathodic protection

As for pipelines with cathodic protection, install meter potential-free. No electric connection from the meter to the pipeline system may exist and power supply is to be provided via isolating transformer.

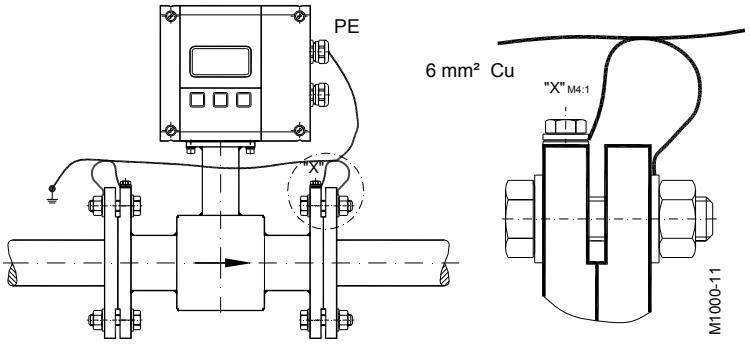
⚠ CAUTION

- *Use grounding electrodes (grounding rings also need to be installed isolated from the pipeline system).*
- *Observe national rules in respect of a potential-free installation*



3.2.9 Electrically disturbed environment

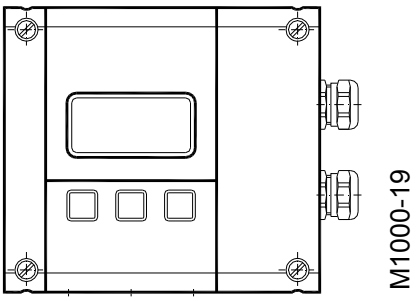
If the pipe material is in an electrically disturbed environment or if metallic pipelines that are not grounded are used, we recommend a groundring as shown in the following picture in order to assure that measurement is not influenced.



4. Power connections

⚠ CAUTION

- *For the 2 x M20 cable inlets only use flexible electric cables.*
- *Use separate cable inlets for auxiliary power, signal and input/output cables.*



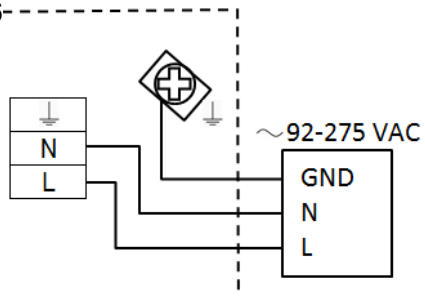
4.1 Auxiliary power

⚠ WARNING

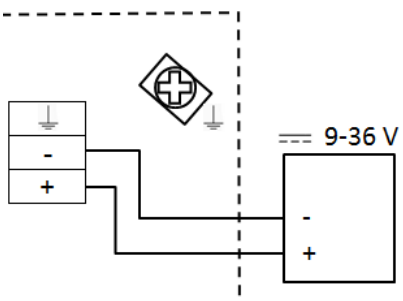
- *Do not connect meter under impressed mains voltage.*
- *Take national applicable rules into account.*
- *Observe type plate (mains voltage and frequency)*
- *Equipment shall be installed with a external means for disconnecting it from each operating energy supply source. The disconnecting means shall disconnect all current-carrying conductors.*

1. Slightly loosen the lower cover screws and both upper cover screws completely. Open cover to the lower side.
2. Push auxiliary power cable through the upper cable inlet.
3. Connection as shown in the picture.
4. In the following close connection cover again firmly.

Power supply 92-275 VAC (50/6-
Recommended cable size min. 0,75 mm²



Power supply 9-36 VDC (max. 9 W)
Recommended cable size min. 0,75 mm²



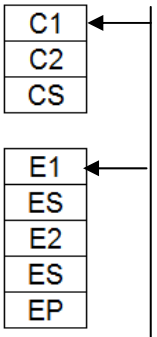
4.2 Separate version

⚠ CAUTION

- *Connect or separate signal connection cable only when the unit has been switched off.*

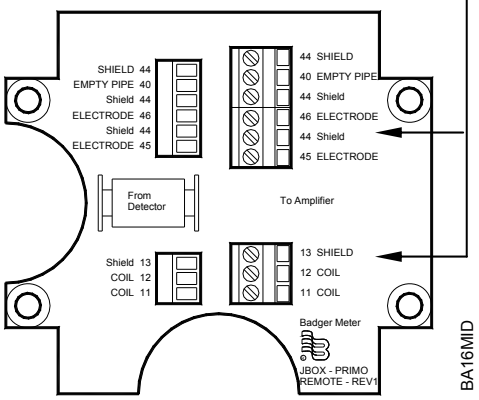
Connection in the measuring amplifier

1. Loosen both fixing screws of the connection cover and remove cover.
2. Loosen upper and lower cover screw and open cover to the left side.
3. Push signal cable on the upper side of the device through cable inlet.
4. Connection as shown in the picture.
5. Close device and connection cover again firmly.



Connection on the detector

1. Loosen fixing screws of the connection cover and remove cover.
2. Push signal cable through cable inlet.
3. Connection as shown in the picture.
4. Close device and connection cover again firmly.



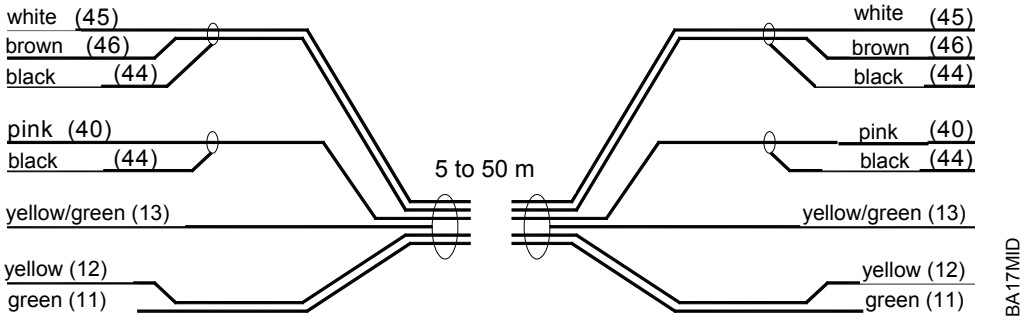
Terminal box – Terminal		M1000	Description	Wire color
Standard	Stainless steel			
11	5	C1	Coil 1	Green
12	4	C2	Coil 2	Yellow
13	PE	CS	Main shield	Yellow/Green
45	1	E1	Electrode 1	White
44*	PE	ES	Electrode shield	Black
46	2	E2	Electrode 2	Brown
40	3	EP	Empty pipe	Pink
44*	PE	ES	Empty pipe shield	Black

*) Connections with number 44 are on the same potential.

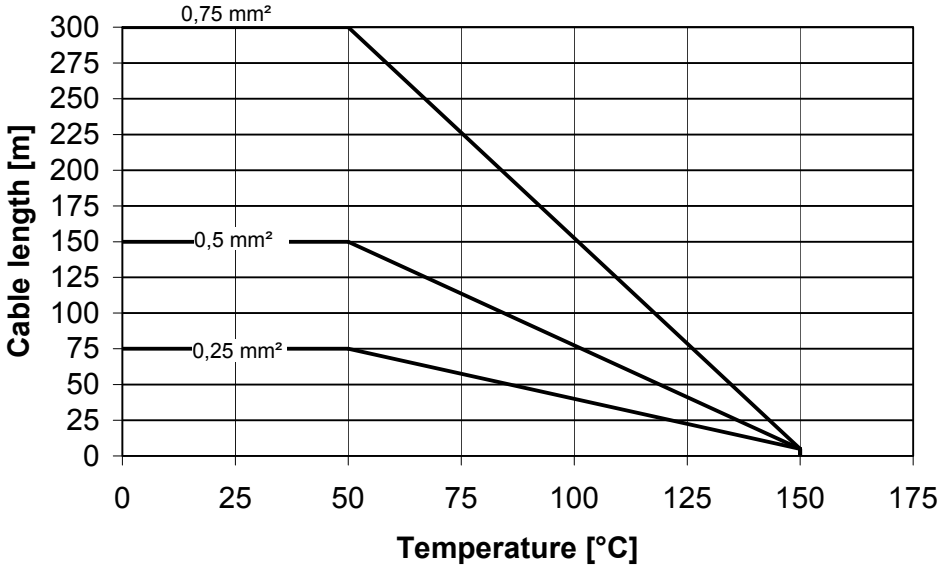
4.2.1 Signal cable specification

Note:
- *Only use signal cables delivered by Badger Meter or corresponding cable in accordance with the following specification.*
- *Take max. signal cable length between detector and amplifier into account (keep distance as low as possible).*

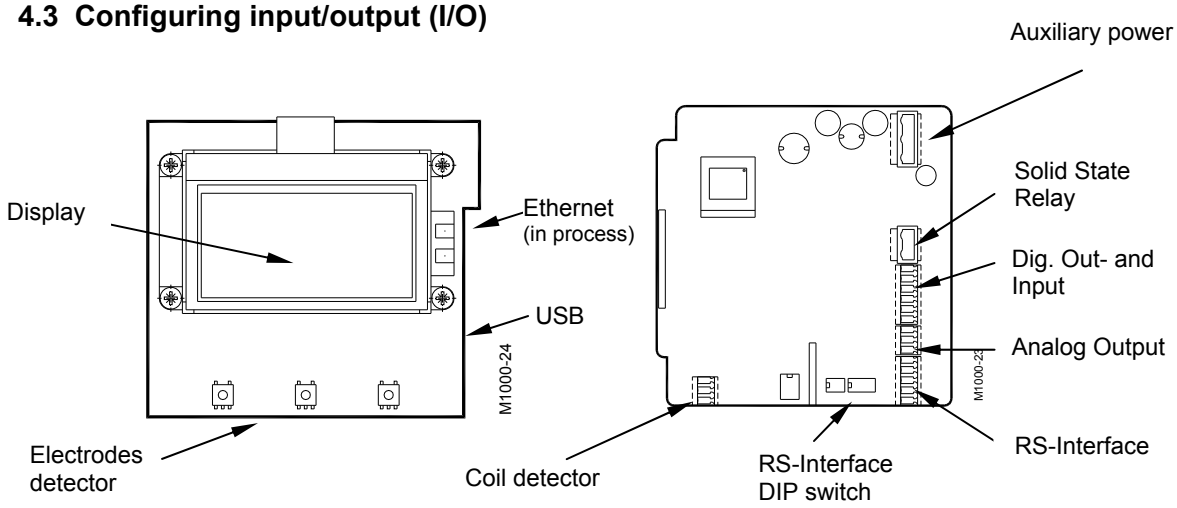
Distance	With electrode idle	Loop resistance
0 – 50 m	3 x (2 x 0,25 mm²)	=< 160 Ω/km
PVC cable with pair and total shield Capacity: wire/wire < 120 nF/km, wire/shield < 160 nF/km Temperature range –30 °C to +70 °C		

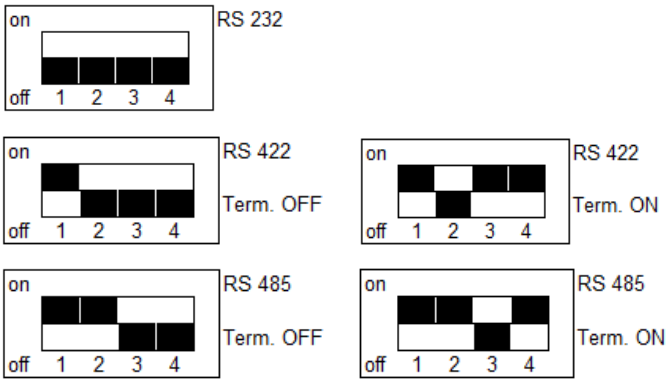


Maximum cable length at different fluid temperatures



4.3 Configuring input/output (I/O)



Input/Output	Description	Terminal
Analog output*	0 - 20 mA 4 - 20 mA RL < 800 Ohm 0 - 10 mA	7 (+) 8 (-) 9 (GND)
Digital output		
1*	Open collector max. 10 kHz • Passive max. 32 VDC, <100 Hz 100 mA, >100 Hz 20 mA • Active 24 VDC, 20 mA (can be powered by analog output if not used)	3 (-) 4 (+)
2*	Open collector max. 10 kHz • Passive max. 32 VDC, <100 Hz 100 mA, >100 Hz 20 mA • Active 24 VDC, 20 mA (can be powered by analog output if not used)	1 (-) 2 (+)
3	Solid State Relais max. 230 VAC, 500 mA, max 1 Hz (Function is linked with Output 2)	S1 and S2 ⚠
Digital input*	5 - 30 VDC	5 (-) and 6 (+)
RS interfaces*	RS232, RS485 and RS422 with ModBus® RTU. Mode can be configured by DIP switches also termination ON or OFF. 	422 / 232 / 485 A / RxD / B / / Z / TxD / B Y / / A G (GND)
USB	USB Device CDC (Host Mass Storage)	Micro USB
Ethernet*	Ethernet Interface connection (in process)	RJ45 socket
* all marked in- and outputs are according to safety data TNV-1 IEC 60950-1		

4.3.1 In- and output cable connection

For the normal I/Os use shielded cables. Connect the shield of the cable to one of the grounding screw. Recommended cable LiYCY size min. 0,14 mm².

Solid State Output

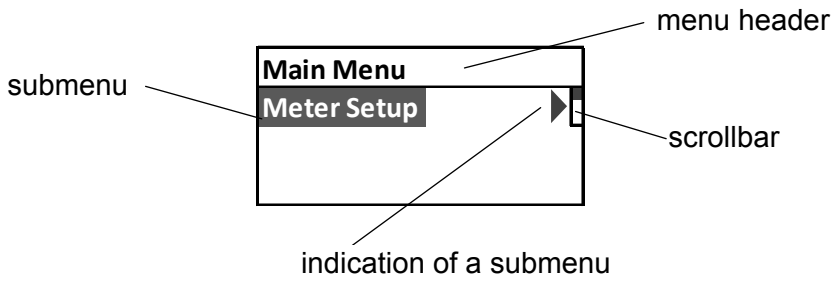
In case the second cable gland is used for the normal I/Os, use one cable and cable gland for the power supply and Solid Satate relay. Recommended cable size min. 0,75 mm².

CAUTION

- *Use separate cable inlets for cables connected to the Solid State Relay output and cables connected to the other input/outputs.*
- *In multiphase nets solid state relay should handle only the same phase which is used for powering the meter.*

5. Programming

Programming is accomplished by using the three functional buttons ▲, ► and **Exit/Save**.
You can move from the measuring mode to the programming mode by pressing once the button **Exit/Save**.



With the ▲ button you move downwards in the list. With the ► or **Exit/Save** button you enter the menu or you move to the next submenu. The scrollbar on the upper right shows at what position you are in the list. Go back from a submenu to the upper menu press **Exit/Save.**

To select parameters or values from a list in a menu point, press key ▲ until the requested parameter or value is displayed and confirm with key **Exit/Save**. The current number in the list is marked by a ▪ on the left side. For example ▪DN 50.

To change a parameter enter the menu by pressing the button ► and the first character flashes. Press the key ▲ to change the figure. Once you have changed the desired figure, move to the next figure with the key ►. Confirm the new value with key **Exit/Save**.

*Meaning of symbols on the display

	Minor battery power (Real Time Clock)
	Empty pipe detection
	Device error
	No keyword active
S	Simulation active
	USB active

You get access to the individual menus through three programmable access levels: Administrator, service and user level.
Access rights of the individual menu items are shown in the following with three symbols:

Administrator

Service

User

For programming the access levels, see the chapter “passwords”.
No passwords were set at the factory.

5.1 Main menu

The following menu items are available to you in the main menu:

- Meter setup
- Measurements
- Inputs and outputs
- Totalizer reset
- Communication
- Miscellaneous
- Information
- Pin

5.1.1 Meter setup

Calibration	**Diameter** 	This figure is used for setting pipe's diameter (size). Several sizes DN 6 to DN 200 can be set. Note: Pipe diameter is set at the factory. Changes of size have an impact on meter's accuracy.
	Detector Factor 	This parameter is set at the factory. This factor compensates for accuracy error as a result of the installed detector. If accuracy adjustment of the meter is required, please refer to the scale factor. In the event the amplifier is replaced, this parameter must be reprogrammed with the original detector factor.
	Detector Zero 	This parameter is set at the factory. This factor compensates for accuracy error as a result of the installed detector. If accuracy adjustment of the meter is required, please refer to the scale factor.
	Amplifier Factor 	Electronic calibration factor Read only
	Coil Current 	Coil current ro the detector Read only
Scale Factor 	Changing the scale factor lets you adjust the meter's accuracy without disturbing parameters set by the factory. You can tune the meter to meet changing application requirements in a range of ±5% (0,95 to 1,05)	

<table>
<tr><td>Power Line Frequency
  </td><td colspan="2">For an optimum operation of the meter, set Power Line Frequency 50 Hz or 60 Hz in this menu at operating location.</td></tr>
<tr><td>Excitation Frequency
  </td><td colspan="2">This value shows in which frequency the meter’s coils are operated. Supported frequencies are dependent on the configured power line frequency and meter’s size.

<table><tr><th>50 Hz</th><th>60 Hz</th></tr><tr><td>3.125 Hz</td><td>3.75 Hz</td></tr><tr><td>6.25 Hz</td><td>7.5 Hz</td></tr><tr><td>12.5 Hz</td><td>15 Hz</td></tr></table>
Note: When selecting excitation frequency, make sure to always observe that the ratio in respect of power frequency is integer.</td></tr>
<tr><td rowspan="3">Empty Pipe Detection
  </td><td>On/Off
  </td><td>Fluid monitoring shows if measuring pipe has only partly been filled with liquid. Monitoring can be switched ON or OFF.

Note: On request, fluid monitoring can be adjusted to fluid’s conductivity or to cable length.</td></tr>
<tr><td>Threshold
  </td><td>Threshold value for empty pipe detection.

For liquids with lower conductivity or long cables the threshold value must be increased. The actual value can be monitored in the next menu “measured”.</td></tr>
<tr><td>Measured

read only</td><td>Monitor the actual measured resistance of the empty pipe detection function.</td></tr>
</table>

5.1.2 Measurement

Flow Unit

Flow Units let you select among the Flow Units mentioned below. Flow units are automatically converted into the selected unit.

	Unit		Unit
L/s	Liter/Second	gal/s	Gallons/Sec.
L/min	Liter/Minute	g/min	Gallons/Min.
L/h	Liter/Hour	g/h	Gallons/Hour
m³/s	Cubic	MG/D	MegaGallon/Day
m³/min	Cubic	IG/s	UKG/Sec.
m³/h	Cubic	IG/min	UKG/Min.
ft³/s	Cubic Feet/Sec.	IG/h	UKG/Hour
ft³/min	Cubic Feet/Min.	Bbl/min	Barrel/Min.
ft³/h	Cubic Feet/Hour.	Oz/min	Ounce/Min.

Totalizer Unit

This parameter establishes the units of measure for the totalizers:

	Unit		Unit
L	Liters	MG	MegaGallons
hL	HectoLiter	IG	Imperial Gallons
m³	Cubic Meters	bbl	Barrel
Ft³	Cubic Feet	Oz	Fluid Ounces
gal	U.S. Gallons	Aft	Acre Feet

Full Scale Flow 	This parameter sets the maximum flow the system is expected to measure. This parameter has influence on other system parameters like analog output or low flow cut-off. In terms of flow velocity, the meter's limit are from 0.1 to 12 m/sec. The full scale flow is valid for both flow directions. Note: If the flow rate exceeds the full scale setting, an error message indicates that the configured full scale range has been exceeded.	
Low Flow Cut-off 	Low Flow Cut-off defines the threshold at which flow measurement will be forced to zero. The cutoff value can be from 0 % to 10 % of the full scale flow. Increasing the threshold will help prevent false reading during "no flow" conditions possible caused by vibrations or liquid fluctuations.	
Flow Direction 	Flow direction lets you set the meter to measure forward flow only (uni-directional) or both forward and reverse flow (bidirectional). Unidirectional means that the flow is totalized in only one direction. The flow direction is indicated by the arrow printed on the detector label. In this mode, T1+ can be used as overall and T2+ as resettable day counter. Bidirectional means the flow is totalized in both directions. The totalizer T1+ and T2+ registers forward flow and the totalizer T1- and T2- in reverse flow direction. The net totalizer T1N and T2N shows the difference between T+ and T-. A change of the flow direction can be signalized by the digital outputs.	
Filter	**Median** 	The Median Filter (MDN) reduce noise on the measuring signal. The filter level can be adjusted from 7 up to 13 or switched off.

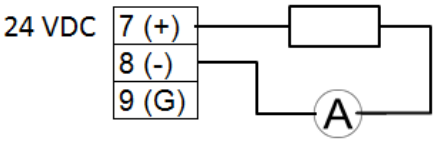
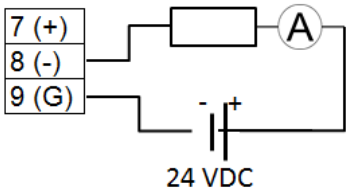
<table>
<tr>
<td></td>
<td>Moving Average
  </td>
<td>Moving average filter (MAV) smooth out short-term fluctuations. The value can be adjusted from 1 to 200 measuring periods.

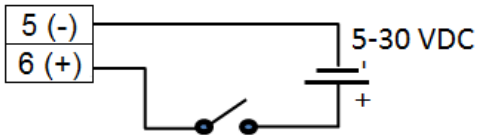
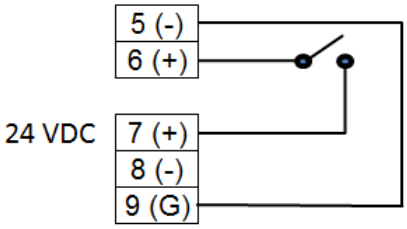
The delay is calculated:
Delay [s] = (MAV – 1) x T
The time T is given by the adjusted excitation frequency of the meter (see also chapter 5.2.1)

<table>
<tr><th>Excitation frequency [Hz]</th><th>T = Time for filter delay (s)</th></tr>
<tr><td>15</td><td>0.03333</td></tr>
<tr><td>12.5</td><td>0.040</td></tr>
<tr><td>7.5</td><td>0.06666</td></tr>
<tr><td>6.25</td><td>0.080</td></tr>
<tr><td>3.75</td><td>0.13333</td></tr>
<tr><td>3.125</td><td>0.160</td></tr>
</table>
For example MAV = 20 and the exciation frequency is 6.25 Hz means T=0,08 s the delay is 1,52 s.</td>
</tr>
<tr>
<td></td>
<td>Display
  </td>
<td>Moving average filter smooth out shortterm fluctuations only for the display. The value can be adjusted from 1 to 200 measuring periods.

Calculations of the delay see “Moving Average” above.</td>
</tr>
</table>

5.1.3 Input and outputs

<table>
<tr><td rowspan="2">Analog output</td><td>Range
  </td><td>This parameter establishes the range of the analog output signal: 0 to 100% (= full scale). The following current ranges are available to you:
<table><tr><td>Current output</td></tr><tr><td>0 to 20 mA</td></tr><tr><td>4 to 20 mA</td></tr><tr><td>0 to 10 mA</td></tr></table>
Analog output active
 
Analog output passive
 
Note:
In case that an error message is displayed, the current is set according the programing of the “Alarm Mode” below.
In case that you select bidirectional operation, you can signal flow direction via digital outputs.</td></tr>
<tr><td>Alarm Mode
  </td><td>This parameter configures the behavior of the analog output during alarm conditions. Three options exist for this parameter: OFF, LOW and HIGH.
OFF: Analog signal is based on flow rate and always within the configured range.
LOW: During alarm conditions, the analog signal will be 2 mA less than the configured lower range. (only on 4-20 mA range).
HIGH: During alarm conditions, the analog signal will be 2 mA more than the configured upper range.
For example, if the analog range is 4 to 20 mA and the alarm mode is set to HIGH, then during a full scale flow alarm condition, the analog output current will be 22 mA.</td></tr>
</table>

Digital Input	Digital input lets you reset totalizers (Remote reset), or interrupt flow measurement (PosZeroReturn). Input switching is provided by applying an external potential of 5 to 30 VDC  or by an internal voltage source of 24 VDC (Analog output if not used). 

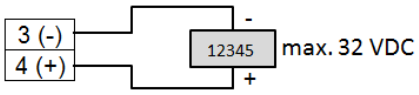
Digital Outputs

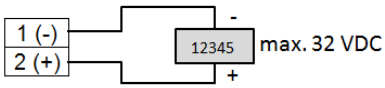
You can configure functional operation of the 2 digital outputs. You can select e.g “forward pulse” for the digital output and define the pulses per totalizer unit via “pulse scale”.

Digital outputs 1 and 2

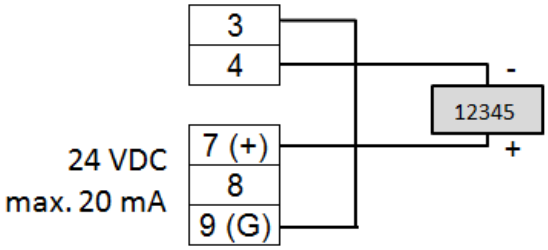
The two outputs can be operated as open collector passively or actively.

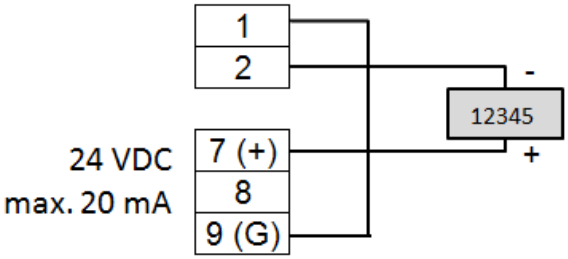
Passive output





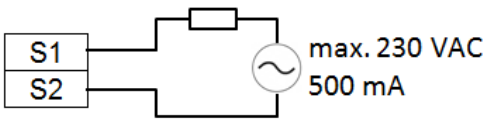
Active output (if analog output is not used)





Solid State Relay

The solid state relay is functional linked with output 2. See functions of output 2.



Digital Outputs

Functional selection

The following functions can be selected for the Outputs 1 to 2 as well as for the Solid State Relay. The Solid State Relay function is linked with the function of output 2.

Function	Out1	Out2 / Solid State Relay
Off	X	X
Forward pulse	X	X
Reverse pulse	X	X
Min/Max Alarm	X	X
Empty pipe	X	X
Flow direction	X	X
Preset	X	X
Error alarm	X	X
Frequency	X	X
Loopback	X	X
Test	X	X

Off means digital output is switched off.

Forward pulse generates pulses during forward flow conditions.

Reverse pulse generates pulses during reverse flow conditions.

Min/Max Alarm provides indication when flow rate exceeds thresholds defined by Set Min. or Set Max. in % of full scale.

Empty pipe alarm provides indication when pipe is empty.

Flow direction provides indication on current flow direction

Preset provides indication when preset batch amount has been realized.

Frequency generates a defined frequency of full scale.

Error alarm provides indication when meter has error condition.

Loopback shows the status of the digital input

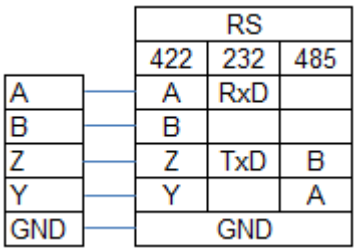
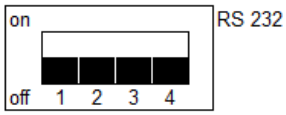
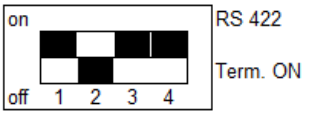
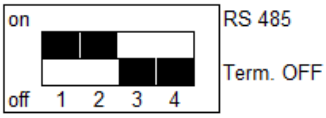
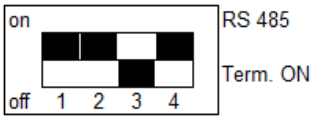
Test is only used for the Verification Device

	Pulse Width 	This parameter establishes the “On” duration of the transmitted pulse. The configurable range ist from 0 msec to 2000 ms. If 0 ms is configured, pulse width is automatically adapted depending on pulse frequency (pulse/pause ratio 1:1). During the configuration the program checks if pulses/unit and pulse width are in accordance with full scale defined, if not an error alarm is displayed. In case of an error alarm, scale, pulse width or full scale need to be adapted.
	Pulse/Unit 	The Pulses/Unit parameter lets you set how many pulses per unit of measure will be transmitted. The max. output frequency of 10,000 pulses/sec. (10 kHZ) must not be exceeded.
	Frequency 	This parameter establishes to define the digital output as frequency output. Full scale frequency can be configured from 0.01 to 10,000 Hz.
	Set Min/Max 	The Flow Set Point (min, max) establishes as a percentage of full scale flow, the threshold at which the output alarm will be activated. You can freely select thresholds in 1% steps. Flow rates below/above the threshold will activate the output alarm.
	Preset Amount 	Preset amount lets you set the reset value for the associated PS totalizer when the digital input is set to Batch Reset. You can configure preset amount in the adjusted volume unit. Preset amount is counted down from the configured value to 0 and a digital output shows that the preset amount has been reached.
	Out Type 1 	The Output Type parameter lets you set the output switch to “normally closed“ or “normally open“.
	Out Type 2 	The Output Type parameter lets you set the output switch to “normally closed“ or “normally open“.
Flow Simulation 	Flow Simulation provides analogue and digital output simulation based on a percentage of the full scale flow in cases where no real flow is occurring. The range of simulation includes -100% to +100% in steps of 10% of the full scale flow. This function still remains active once you have left the menu. It is necessary to set it to “Off” to deactivate it. If the simulation is still active, a character “S” will be displayed in the measuring mode.	

5.1.4 Clear totals

T2 	The unidirectional totalizer T2 is reset within the menu manager.

5.1.5 Communications

Interfaces	ModBus® RTU	RS232, RS485 and RS422 with ModBus® RTU.  Mode can be configured by DIP switches also if Termination ON or OFF.     
	M-Bus (in process)	Optional and needs additional hardware board
	HART (in process)	Optional and needs additional hardware board
ModBus	ModBus® RTU	
	Address	Address available form 1 to 247
	RS-232, RS-422, RS-485	Baudrate: 1200, 2400, 4800, 9600, 19200, 38400 Bd Parity: Even, Odd, Mark
M-Bus	Address	Optional and needs additional hardware board

Ethernet (in process)	ModBus® TCP/IP with MEAP-Header	
	IP Address	IPv4-Address
	IP Mask	IPv4 subnetting reference
	IP Gateway	Gateway address
	MAC Address	Media-Access-Control-Address
ADE	Control	On or Off
	Protocol	1 or 2
	Dial	4 to 9
	Resolution	0,001 / 0,01 / 0,1 / 1 / 10 / 100 / 1.000 / 10.000

5.1.6 Miscellaneous

Log	Off, On and Preset
Power up	The number of times that the unit has been powered on.
Settling time	Measures settling of coils and must be less than one quarter of excitation period. 0 ms in case no detector is connected.
Language	The unit supports different languages as : • English • German • Czech • Spanish • French • Russian • Italian
Date	Set date of the system in the format [DD.MM.YY] used for data logging
Time	Set time of the system in the format [HH.MM.SS] used for data logging
EEPROM	Delete all data logging information from the EEPROM. Note: System parameters and totalizers are not affected.
Polar Voltage	Measure electrode polarizing voltage in ± V (just for service purpose)
Display Rotation	The Display can be rotated by 0 °, 90 °, 180 ° and 270 °.
Contrast	The contrast of the display can be adjusted between 14 (low) and 49 (high)

Datalog Period	The data logging period can be adjusted as following: every 15 min / 1 h / 6 h / 12 h / 24 h There is a 500 kB memory with about 30.000 data records for data logging available. The logging capacity is as following (uni-directional mode): Period of 15 min up to 312 days 1 h up to 1250 days 6 h up to 20 years 12 h up to 40 years 24 h up to 80 years Start up-, configuration- and Error events which are logged can reduce the data logging capacity. Logging in Bi-directional mode reduce the logging capacity by about 40%. The logging information can be downloaded by a PC program which is not supplied with the meter.

5.1.7 Info

Serial number	Serial number of the electronic board.
Version	Software version of the device.
Compilat. Date	Date of the software version.
Otp CRC	Checksum of software update
Applicat. CRC	Checksum of application

5.1.8 Pin

The different menus and parameterings can be secured via three password levels.

- Administrator PIN 
- Service PIN 
- User PIN 

The password protection is a 6-digit PIN which is parametered on [000000] and deactivated at the factory.

At the first time activate the password protection Control = On
Enter Login with the password 000000.
Now you can go back to the PIN again and enter [User], [Service] and [Admin] password.

Once the password protection has been activated, please enter your PIN under Login; the symbol (lock open)  appears. The PIN grants you access to either Administrator, Service or User level with the respective access rights (marked with A, S and U in the manual). You can now move to the menu and enter your parameters.

Without login, you can read all parameters, but cannot change them.

Control	Activate and deactivate the PIN
User	User logged in with this PIN will have access to all user-levels. Users at this level do not have access to Service or Admin functions.
Service	User logged in with this PIN will have access to both service and user-level procedures. User at this level will not have access to administrative functions.
Admin	User logged in with this PIN will have access to both service and user-level procedures.

5.1.9 Login

Login	Once the password protection has been activated, please enter your PIN

6. Troubleshooting

The following error messages can be displayed:

Description	Possible cause	Recommended action
Coil Disconnected	▪ Meter not connected. ▪ Connection to meter interrupted. ▪ Detector electronics or coils defective.	Check if meter is connected and make sure that cable connection is not interrupted. Otherwise contact Service Department.
Coil Shorted	Coil cables shorted	Check coil cables
Empty pipe	▪ Pipe may not be full ▪ Medium with low conductivity ▪ Cable broken or disconnected	Make sure that pipe is always filled at the measuring point. Eventually calibrate new, see calibration of fluid monitoring Check the cable for the empty pipe signal
Range	Actual flow rate is exceeding the programmed full scale by more than 25 %	Reduce flow rate or increase the programmed full scale.
Pulse Output	Pulse rate exceed the maximum	Reduce pulse scale (pulse/unit) and/or reduce pulse width configuration
AD Error	Input signal from detector too high.	Check the grounding scheme of the meter installation. See grounding section in manual.
Excitation Frequency	The excitation frequency is too high for this detector	Decrease the excitation frequency in the Meter Setup
EEPROM	Configuration file is missing	Contact support
Configuration	Configuration file is corrupted	Contact support
Low Battery	Low backup battery (memory)	Contact support
Measure Timout	Measurement was not completed within specific time	Contact support

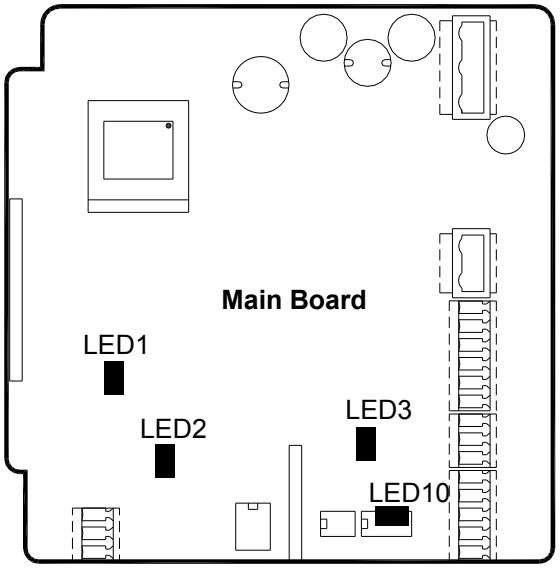
Some frequently occurring errors are listed in the following:

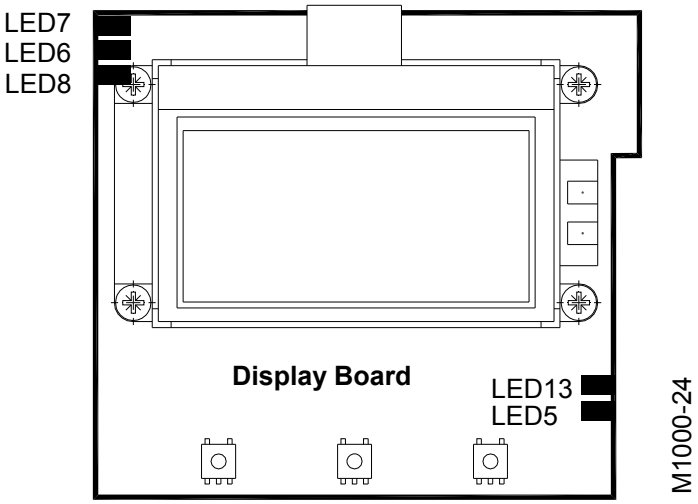
Other error	Possible Cause	Recommended Action
Meter does not function	▪ No auxiliary power.	▪ Provide auxiliary power.
Fluid is flowing, however display shows zero	▪ Signal cable is not connected or connection is interrupted. ▪ Detector installed opposite to forward flow direction (see arrow on type plate). ▪ Connection cable for coils or electrodes mixed-up.	▪ Check signal cable. ▪ Turn detector by 180°. ▪ Check connection cable.

Inaccurate measurement	▪ Wrong parameters. ▪ Pipe not completely full.	▪ Check parameters (detector, amplifier and size) as per annexed data sheet ▪ Check if measuring pipe completely full.

6.1 Control LED

On the board there are several LED to control the operation of the device. See below the LEDs and the meaning

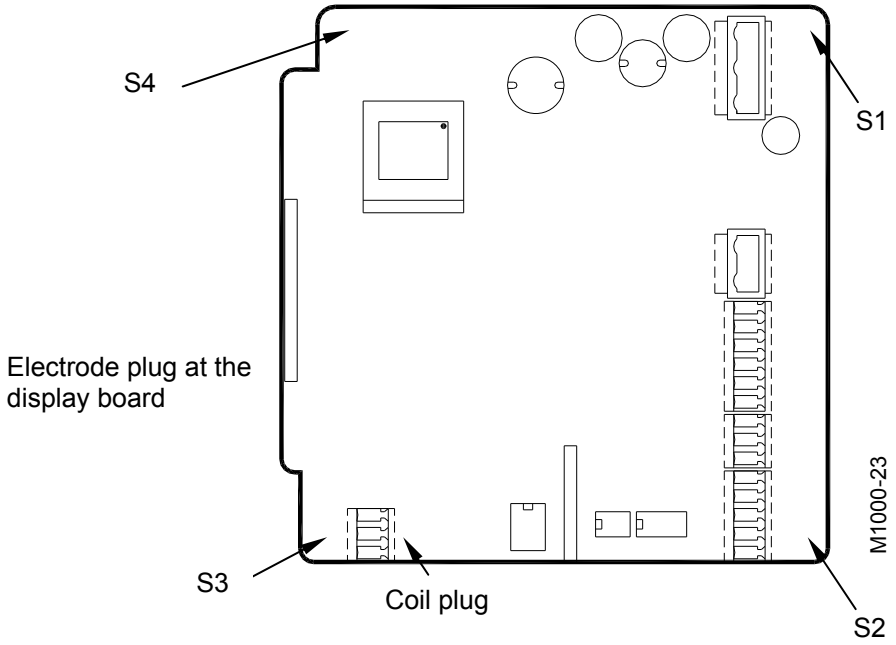




LED1	Coil loop (On = active / Off loop open)
LED2	Communication – receive (On = active)
LED3	Communication – transmit (On = active)
LED5	Flash memory activity (DISK)
LED6	Digital output #1 (On = active)
LED7	Digital output #2 (On = active)
LED8	Digital input (On = active)
LED10	Power ON (On = active)
LED13	USB, HOST mode (On = active)

6.2 Replace meter's electronics

Warning: • *Disconnect auxiliary power before opening body cover.*



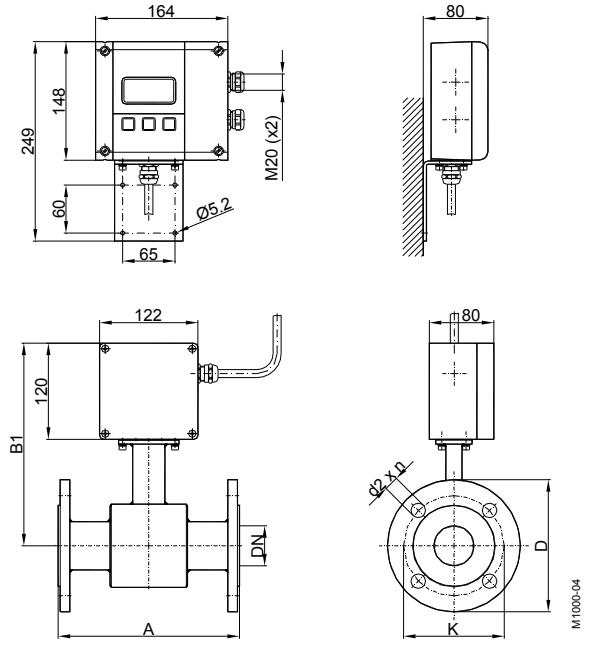
1. Pull out all plugs. Loosen screws S1-S4 and take out circuit board.
2. Insert new circuit board and fix it by fastening the screws S1-S4. Plug again all plugs.
3. If necessary, configure new circuit board related to the available meter (detector, size).

7. Technical data

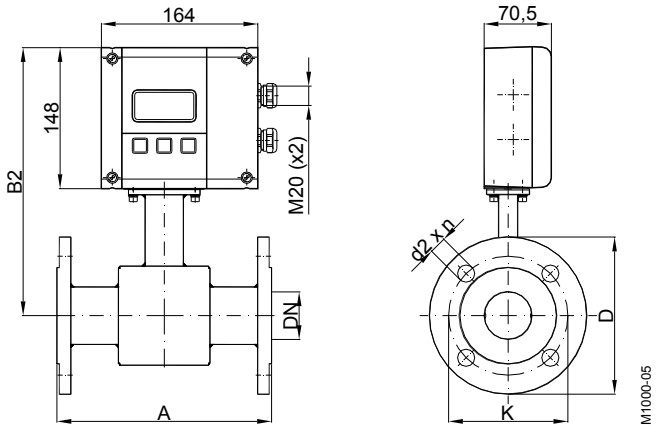
7.1 Detector Type II

Technical data			
Size	DN 6 – DN 200 (1/4“ to 8“)		
Process connections	Flange: DIN, ANSI, JIS, AWWA etc.		
Nominal pressure	Up to PN 100		
Protection class	IP 67, IP 68 optional		
Min. conductivity	5 µS/cm (20 µS/cm demineralized water)		
Liners	Hard/soft rubber	from DN 25 onward	0 °C to +80°C
	PTFE	DN 6 - DN 200	-40 °C to +150 °C
Electrodes	Hastelloy C (Standard) Tantalum	Platinum/Gold platinized Platinum/Rhodium	
Body	Steel/stainless steel optional		
Overall length	DN 6 – DN 20	170 mm	
	DN 25 – DN 50	225 mm	
	DN 65 – DN 100	280 mm	
	DN 125 – DN 200	400 mm	

Process connection flange
ModMAG® M1000 wall mounting
(in mm)



Process connection flange
ModMAG® M1000 mounted version
(in mm)



DN		A Std*	A ISO**	B1	B2	ANSI flanges			DIN flanges		
						∅ D	∅ K	∅ d2xn	∅ D	∅ K	∅ d2xn
6	1/4”	170	---	228	256	88,9	60,3	15,9 x 4	90	60	14 x 4
8	3/10”	170	---	228	256	88,9	60,3	15,9 x 4	90	60	14 x 4
10	3/8”	170	---	228	256	88,9	60,3	15,9 x 4	90	60	14 x 4
15	1/2”	170	200	238	266	88,9	60,3	15,9 x 4	95	65	14 x 4
20	3/4”	170	200	238	266	98,4	69,8	15,9 x 4	105	75	14 x 4
25	1”	225	200	238	266	107,9	79,4	15,9 x 4	115	85	14 x 4
32	1 1/4”	225	200	253	281	117,5	88,9	15,9 x 4	140	100	18 x 4
40	1 1/2”	225	200	253	281	127	98,4	15,9 x 4	150	110	18 x 4
50	2”	225	200	253	281	152,4	120,6	19 x 4	165	125	18 x 4
65	2 1/2”	280	200	271	299	177,8	139,7	19 x 4	185	145	18 x 4
80	3”	280	200	271	299	190,5	152,4	19 x 4	200	160	18 x 8
100	4”	280	250	278	306	228,6	190,5	19 x 8	220	180	18 x 8
125	5”	400	250	298	326	254	215,9	22,2 x 8	250	210	18 x 8
150	6”	400	300	310	338	279,4	241,3	22,2 x 8	285	240	22 x 8
200	8”	400	350	338	366	342,9	298,4	22,2 x 8	340	295	22 x 12

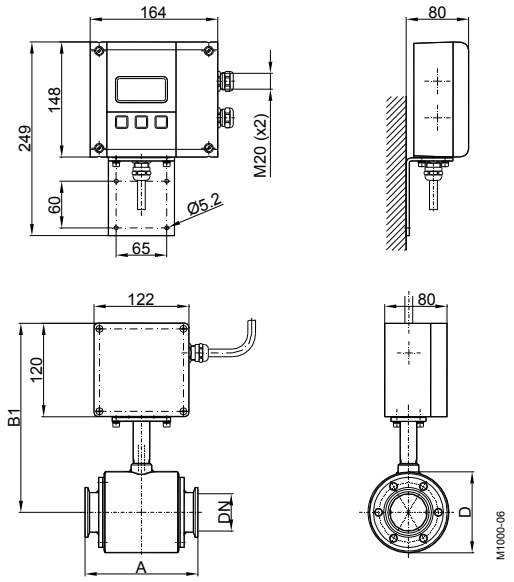
Standard		
ANSI flanges	from DN 6 - DN 200	pressure 150 lbs
DIN flanges	from DN 6 – DN 200	pressure PN 16

* Standard **ISO 13359

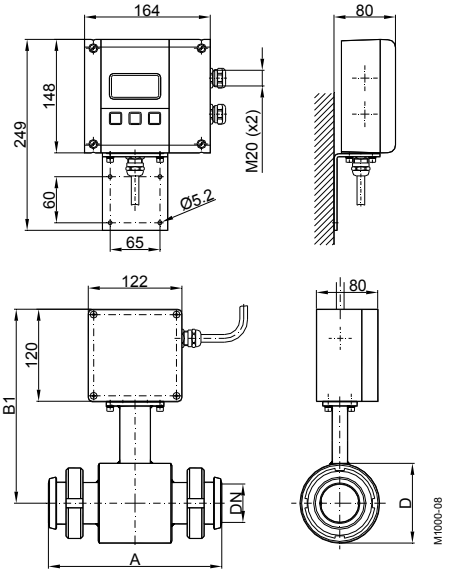
7.2 Detector type Food

Technical data			
Size	DN 10 – DN 100 (3/8“ to 4“)		
Process connections	Tri-Clamp®, DIN 11851, ISO 2852, etc.		
Nominal pressure	PN 10		
Protective class	IP 65, IP 68 optional		
Min. conductivity	5 µS/cm (20 µS/cm demineralized water)		
Liners	PTFE	-40 °C to +150 °C	
Electrodes	Hastelloy C (Standard) Tantalum	Platinum/Gold platinized Platinum/Rhodium	
Body	Stainless steel		
Overall length	Tri-Clamp® connection	DN 10 – DN 50	145 mm
		DN 65 – DN 100	200 mm
	DIN 11851 connection	DN 10 – DN 20	170 mm
		DN 25 – DN 50	225 mm
		DN 65 – DN 100	280 mm

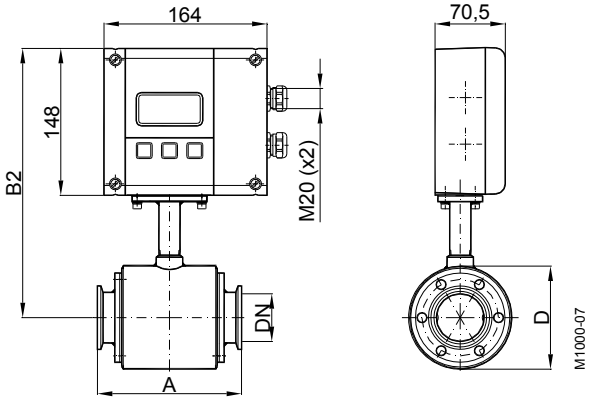
Process connection Tri-Clamp®
ModMAG® M1000 Wall mounting
(in mm)



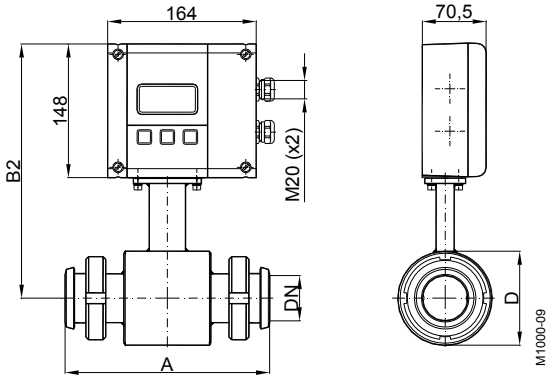
Process connection DIN 11851
ModMAG® M1000 Wall mounting
(in mm)



Process connection Tri-Clamp®
ModMAG® M1000 mounted version
(in mm)



Process connection DIN 11851
ModMAG® M1000 mounted version
(in mm)



Type Food Tri-Clamp®

DN		A	B1	B2	D
10	3/8”	145	228	256	74
15	1/2”	145	228	256	74
20	3/4”	145	228	256	74
25	1”	145	228	256	74
40	1 ½“	145	238	266	94
50	2”	145	243	271	104
65	2 ½“	200	256	284	129
80	3”	200	261	289	140
100	4”	200	269	297	156

Pressure PN 10 Dimensions (mm)

Type Food Milk Pipe DIN 11851

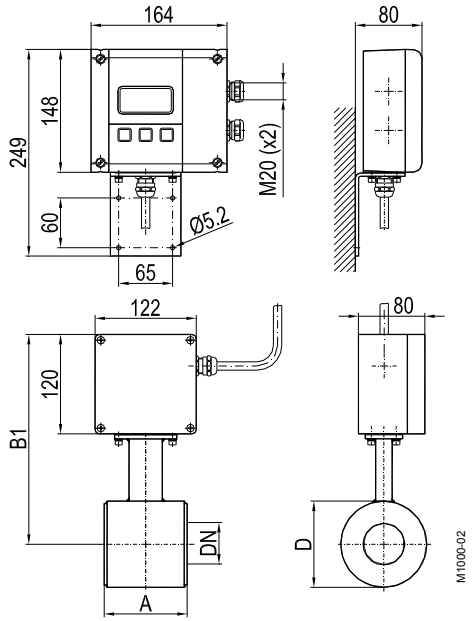
DN		A	B1	B2	D
10	3/8”	170	238	266	74
15	1/2”	170	238	266	74
20	3/4”	170	238	266	74
25	1”	225	238	266	74
32	1 ¼“	225	243	271	84
40	1 ½“	225	248	276	94
50	2”	225	253	281	104
65	2 ½“	280	266	294	129
80	3”	280	271	299	140
100	4”	280	279	307	156

Pressure PN 16 Dimensions (mm)

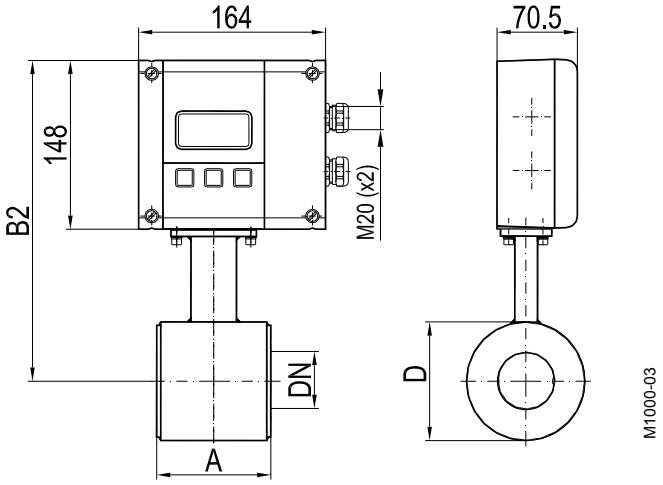
7.3 Detector Type III

Technical Data		
Size	DN 25 – DN 100 (1“ to 4“)	
Process connections	Sandwich connection, (intermediate flange mounting)	
Nominal pressure	PN 40	
Protective class	IP 67, IP 68 optional	
Min. conductivity	5 µS/cm (20 µS/cm demineralized water)	
Liner	PTFE	-40 °C to +150 °C
Electrodes	Hastelloy C (Standard) Tantalum	Platinum/Gold platinized Platinum/Rhodium
Body	Steel/stainless steel optional	
Overall length	DN 25 – DN 50	100 mm
	DN 65 – DN 100	150 mm

Sandwich connection
ModMAG® M1000 wall mounting
(in mm)



Sandwich connection
ModMAG® M1000 mounted version
(in mm)

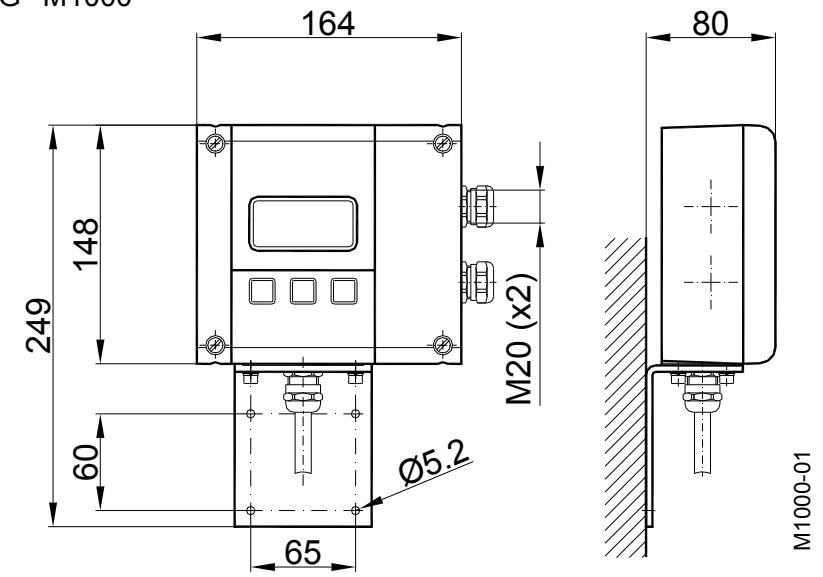


DN		A	B1	B2	D
25	1”	100	238	266	74
32	1 ¼“	100	243	271	84
40	1 ½“	100	248	276	94
50	2”	100	253	281	104
65	2 ½““	150	266	294	129
80	3”	150	271	299	140
100	4”	150	279	307	156
Pressure PN 40					

7.4 Meter type ModMAG® M1000

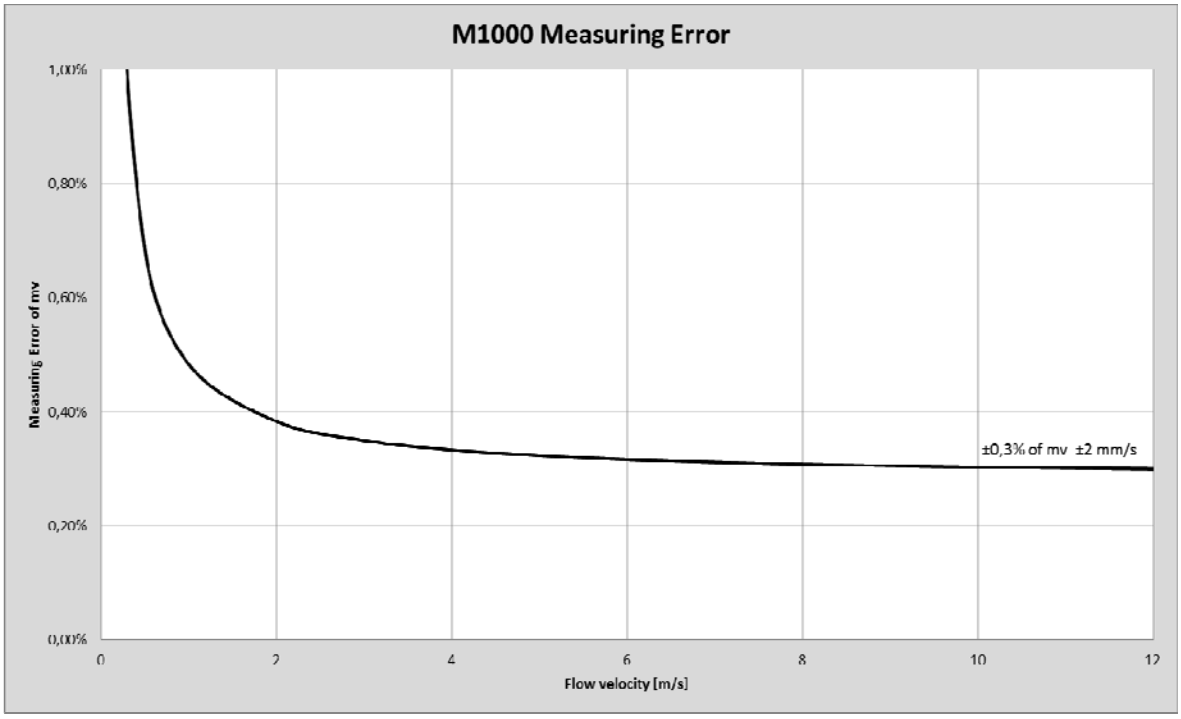
Technical data	
Type	ModMAG® M1000
Auxiliary power	92-275 VAC (50 / 60 Hz), < 14 VA optional 9-36 VDC, < 4 W
Analog output	0/4 – 20 mA, ≤ 800 Ohm
	Flow direction is displayed via separate status output
Digital outputs	2 open collectors, passive 32 VDC, 0-100 Hz 100 mA, 100-10.000 Hz 20 mA, optional active Pulse, status, error messages
Digital inputs	Totalizers and preselectors reset Positive Zero Return
Fluid monitoring	Separate electrode for empty pipe detection
Configuration	3 buttons
Interfaces	RS232, RS422, RS485, ModBus® RTU, Ethernet (in process)
Measuring range	0,03 m/s to 12 m/s
Measuring accuracy	±0,3% of m.v., ±2 mm/s
Reproducibility	0,1%
Flow direction	Bidirectional
Pulse length	Configurable up to 2000 msec.
Outputs	Short-circuit-proof and galvanically separated
Low flow cutoff	0 – 10%
Display	Graphical LCD 64x128, backlight, actual flow rate, totalizers, status display
Body	Powder-coated alu die casting
Protective class	IP 67
Cable inlet	Supply and signal cables 2 x M20
Signal cable	From meter M20
Ambient temperature	-20 °C to + 60 °C

Dimensions
ModMAG® M1000
(in mm)



7.5 Error limits

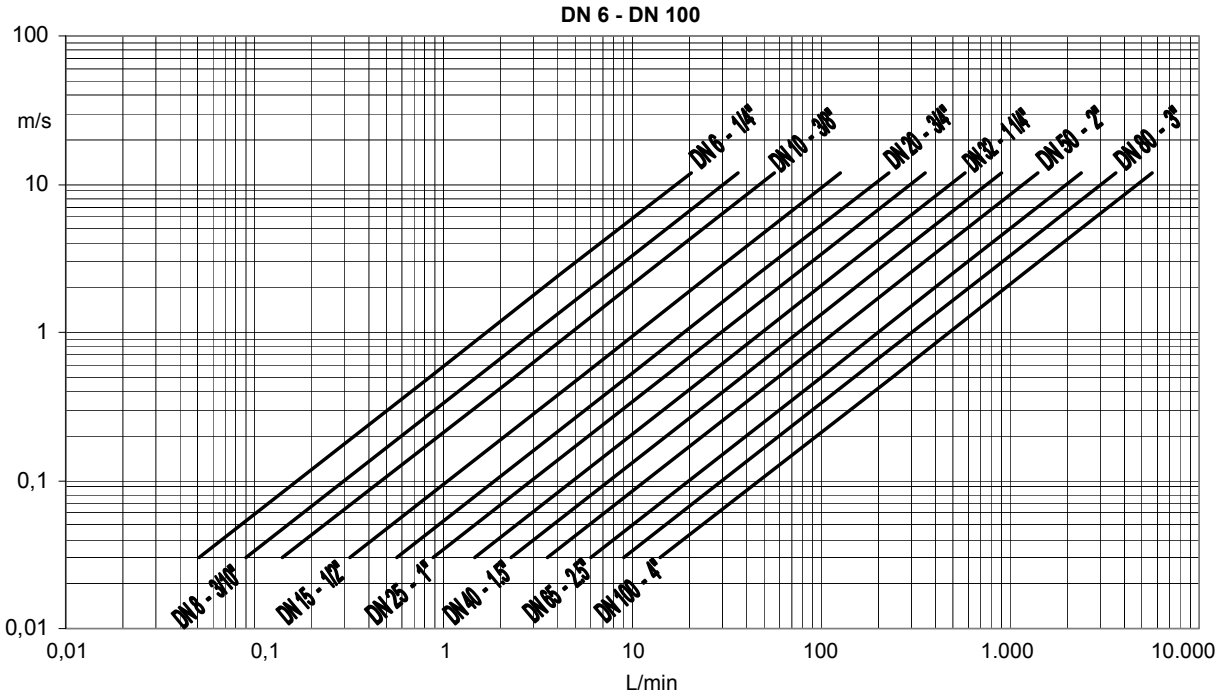
Measuring range	:	0,03 m/s to 12 m/s
Pulse output	:	±0,3% of m.v. ± 2 mm/s
Analog output	:	Similar to pulse output plus ±0,01 mA
Reproducibility	:	±0,1%

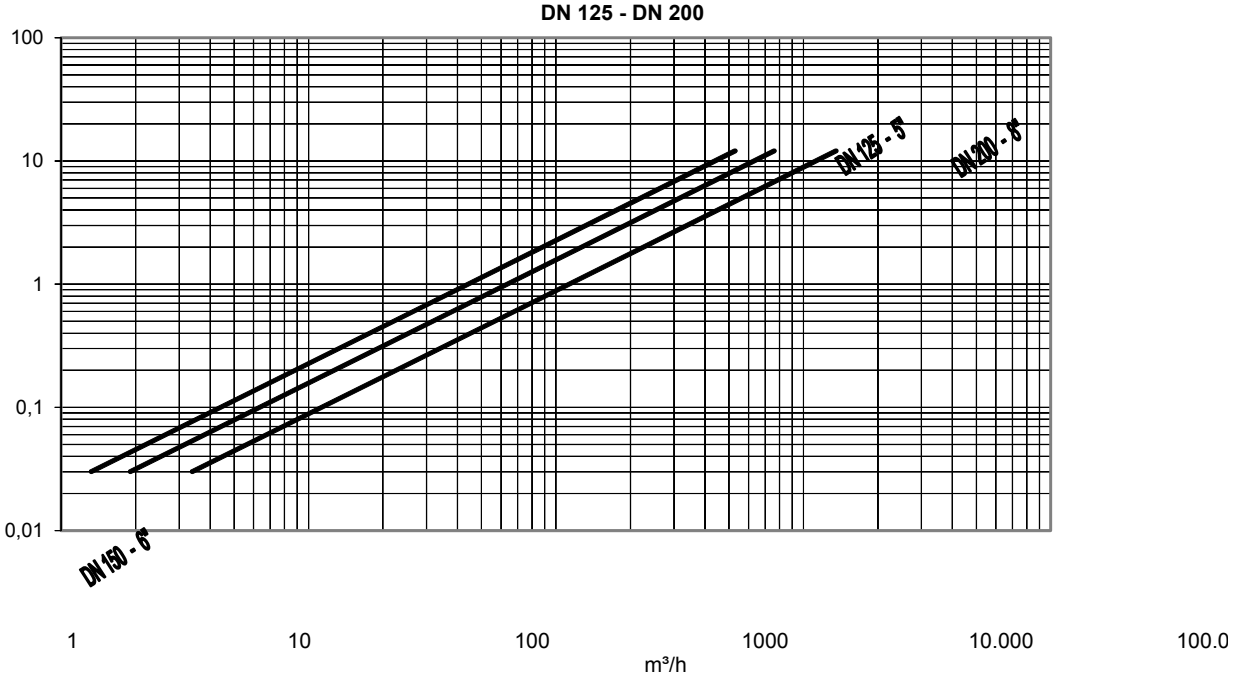


Reference conditions:

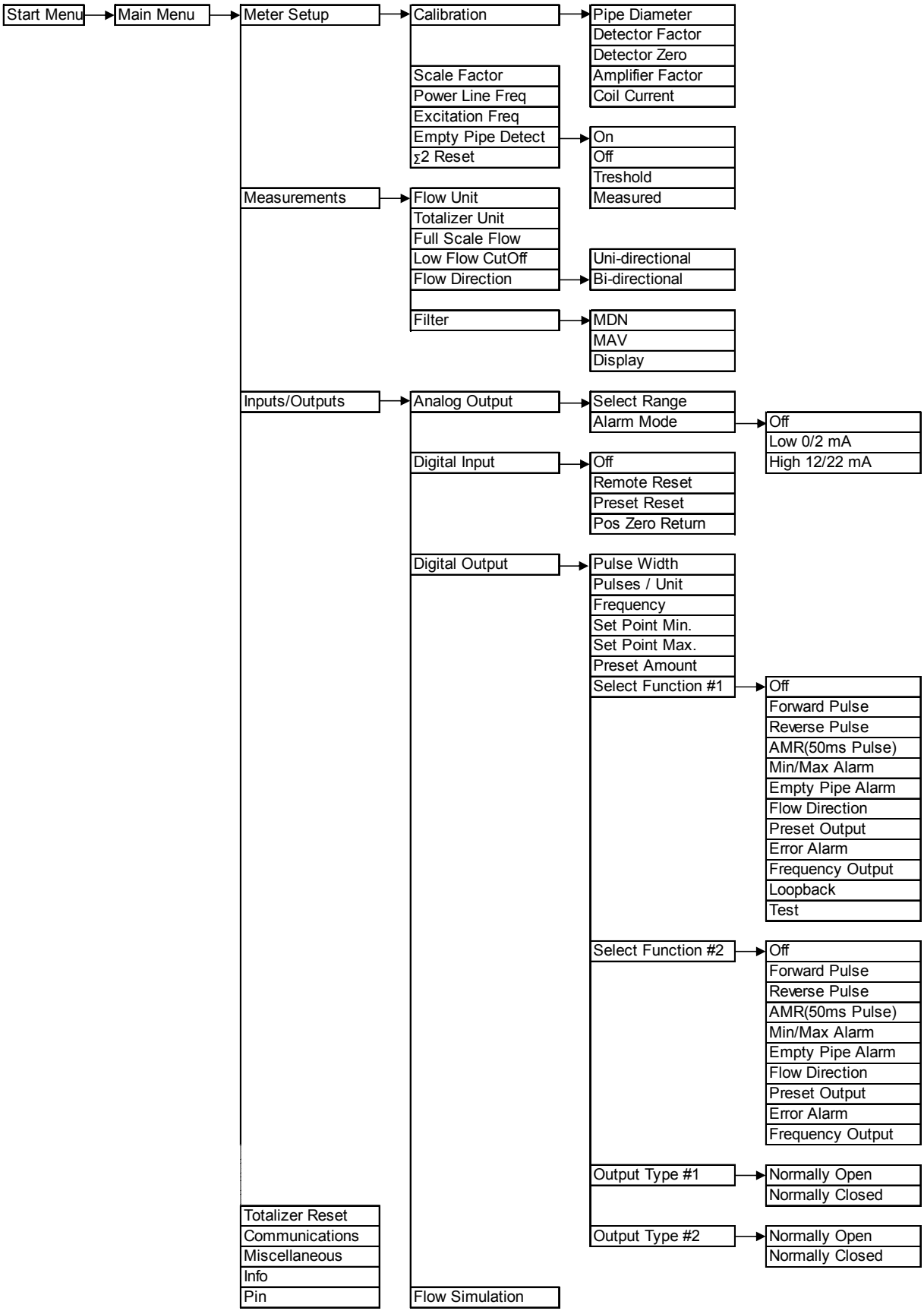
Ambient and fluid temperature	:	20 °C
Electr. conductivity	:	> 300 µS/cm
Warm-up period	:	60 min
Mounting conditions	:	> 10 DN inlet pipe > 5 DN outlet pipe Detector properly grounded and centered.

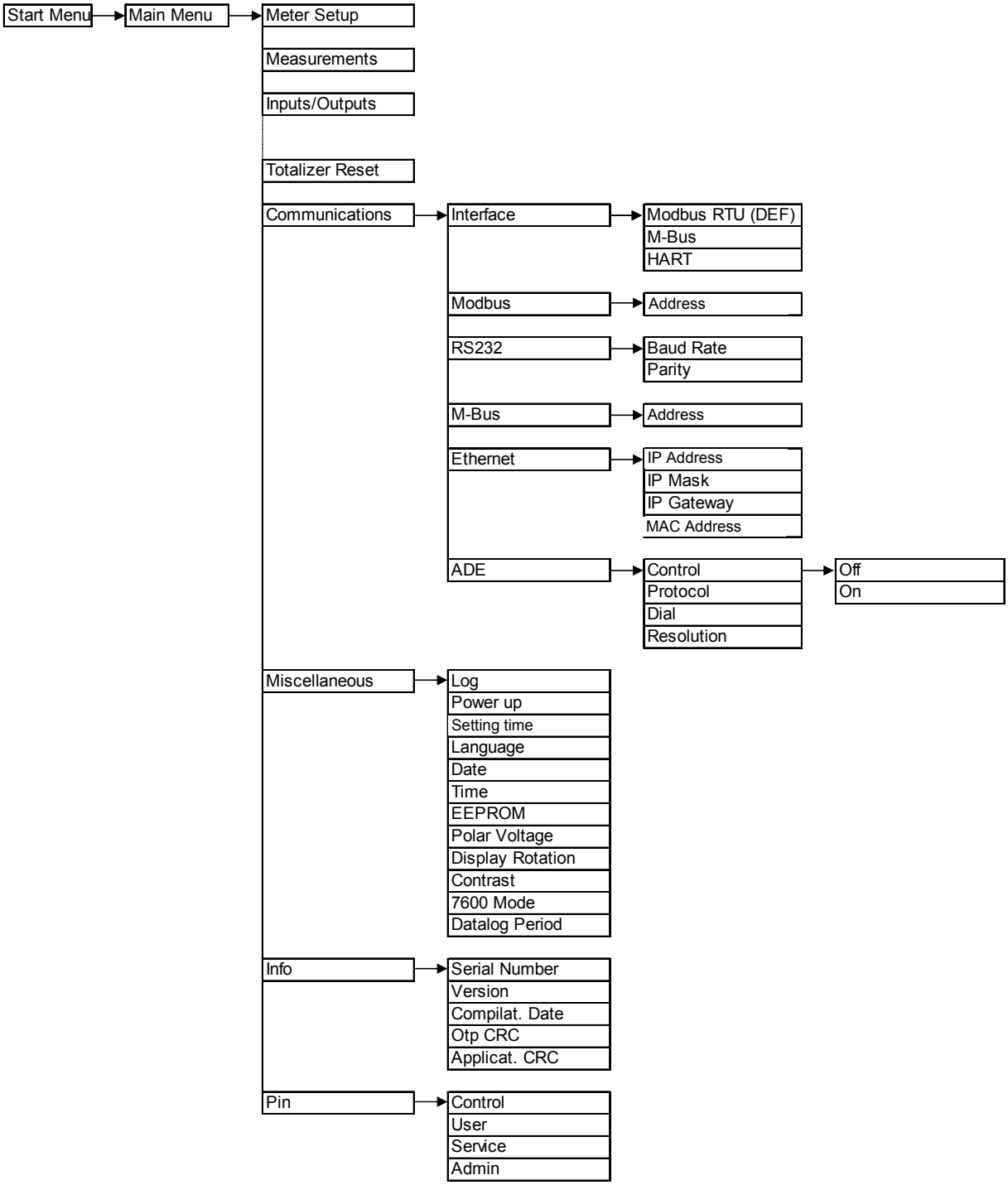
7.6 Size select





8. Program structure




Start Menu
Main Menu
Meter Setup
Measurements
Inputs/Outputs
Totalizer Reset
Communications
Interface
Modbus RTU (DEF)
M-Bus
HART
Modbus
Address
RS232
Baud Rate
Parity
M-Bus
Address
Ethernet
IP Address
IP Mask
IP Gateway
MAC Address
ADE
Control
Off
On
Protocol
Dial
Resolution
Miscellaneous
Log
Power up
Setting time
Language
Date
Time
EEPROM
Polar Voltage
Display Rotation
Contrast
7600 Mode
Datalog Period
Info
Serial Number
Version
Compilat. Date
Otp CRC
Applicat. CRC
Pin
Control
User
Service
Admin

9. Return of goods for repair

Please refer to our claims return form / harmlessness declaration under:
http://www.badgermeter.de/en/service/return-of-goods.html

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